A Three-Level Railway Crossing at Chicago

The comprehensive system of track elevation for the elimination of railway grade crossings of streets in Chicago is complicated at some points by the existence of railway track crossings at the street level. Some of these are retained as track crossings, but removed above the street level. Others are eliminated by raising one of the intersecting lines to cross the street and raising the other line to a sufficient height to carry it across the lower elevated line as well as the street. An interesting case of this latter class is the crossing of the Chicago, Rock Island & Pacific Ry. and the Chicago & Western Indiana R.R. at 79th St. (Auburn Park), which was originally planned as belonging to the former class of crossing. It forms a part of the track-elevation scheme of the C., R. I. & P. Ry., described in our last week's issue.

The two railway lines intersect at an angle of about 17°, which will be modified to about 22° in the new work. The street will be lowered about 7 ft. below the normal level (with approach grades of 3%). The Chicago & Western Indiana line will be elevated about 10 ft. (or to 17 ft. above the new street level), giving a clearance of 13 ft. 6 in. in the subway. The Rock Island line will be elevated about 33 ft. above the present level (or 40 ft. above the street at the crossing), giving a clearance of 17 ft. above the tracks of the other road.

This crossing under construction is shown in Fig. 1, with the old grade crossing at the right, and three of the five spans of the high-level line erected. The Rock Island tracks are on the far side of the watchman's cabin, while the Western Indiana tracks are in the foreground and on a curve. These latter tracks (ten in number) will run through between the piers, being raised to about the level of the top of the pyramidal footings of the piers. At the right is a locomotive crane setting one of the main girders, and at the left is the hollow abutment, above which rises the elevator tower and chute of one of the concreting trains. The general layout of the crossing is shown in Fig. 2.

The work is being done without interruption to traffic, although 450 to 500 trains pass over the crossing daily. The tracks were diverted and the crossing shifted tem-

Fig. 1. High-Level Viaduct of Double-Deck Crossing of the Rock Island Lines and Chicago & Western Indiana R.R. at 79th St., Chicago

(The present tracks are at the street level. The five Rock Island tracks will be on the five-span girder bridge. The ten Western Indiana tracks will pass beneath this bridge, but raised to about the level of the tops of the cars shown so as to pass over the street)

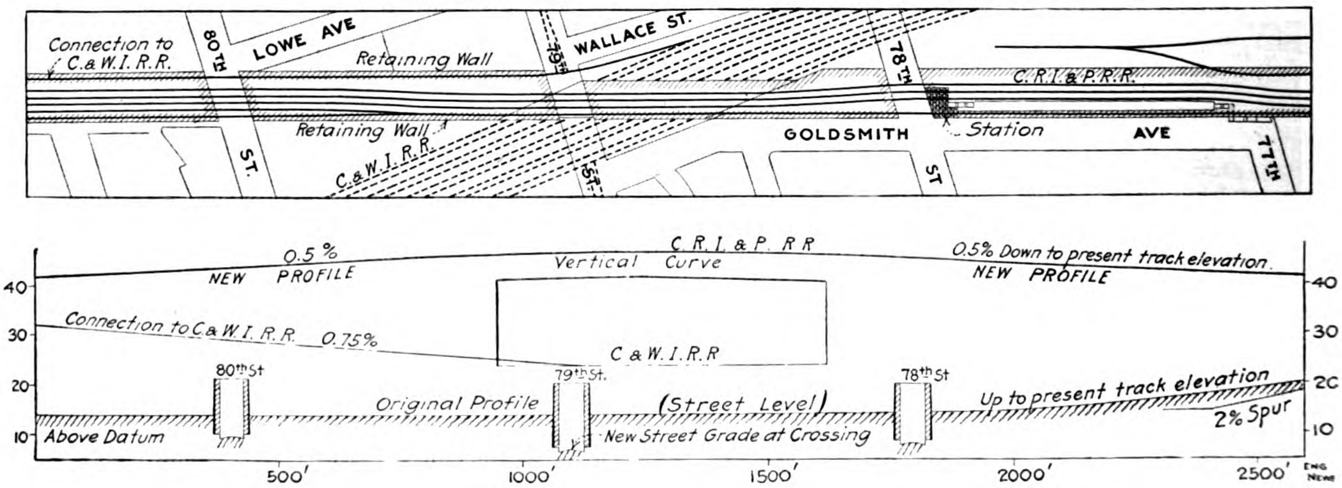

Fig. 2. Plan and Profile of Double-Deck Track Crossing at 79th St., Chicago

porarily, so as to leave the east side of the right-of-way clear for the construction work. The structure will be built first for three tracks, with a temporary approach of 1½% grade at the south end. When this portion is completed traffic will be diverted from the surface tracks to the elevated tracks, and construction work prosecuted on the west side of the right-of-way for the other tracks. During the progress of the work the switches and signals are operated by hand.

The original crossing had four tracks for the C. & W. I. R.R. and three for the Rock Island Lines, but the new crossing will have ten and five tracks respectively, with an interchange connecting track on a grade of 0.75%, as shown in Fig. 2. The number of trains over the crossing is 464 per 24 hr., about equally divided between the two lines, while the work-train movements bring the total to about 500 trains in all. This heavy traffic constitutes one of the difficulties encountered in carrying on the work rapidly and economically, but the regular traffic is being handled practically without interruption.

The viaduct at the street crossing is a double-deck E-55 loading, and a tractive force of 16% of the live-load on a 90-ft. span. The assumed wind load is 30 lb. per sq. ft. on the girders and piers (acting at right angles to the piers); and for the train a wind load of 400 lb. per lin. ft. of track, applied 7 ft. above the rails.

At the street crossing, the ends of the piers are incorporated in the abutments of the span for the low-level bridge. To support the floor-beams across the street, three lines of deck-girders are placed in line with the piers, bridging the gap over the street (Fig. 3). This part of the structure requires two columns in the street, but these are so located as to be combined with the columns of the low-level span. These columns are founded on concrete piers built in open wells carried down to solid rock.

The abutments are of unusual design (Fig. 5). Instead of being in the form of a retaining-wall with solid fill behind, each abutment is a long narrow hollow structure, the two parallel walls being pierced with openings and supporting a slab deck over the interior space, through which extends the slope of the fill. This construction, shown in Fig. 5, was adopted as being cheaper and giving

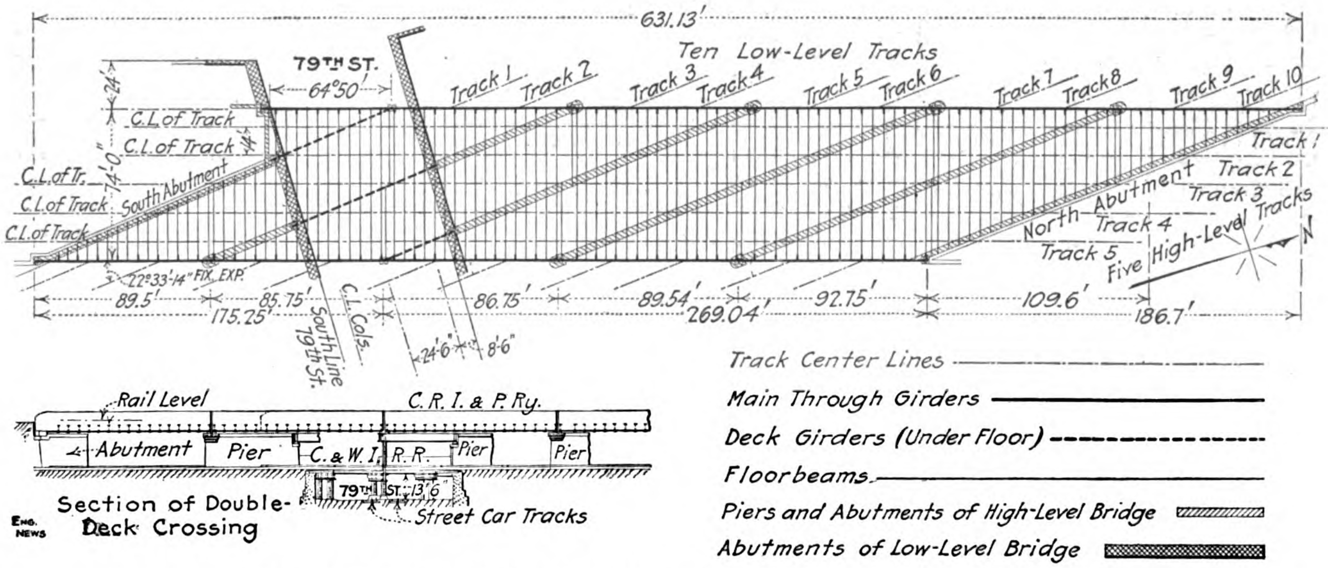

FIG. 3. PLAN AND ELEVATION OF 79TH ST. BRIDGE; ROCK ISLAND LINES

structure, as the point of intersection of the two railway lines is just north of the street. The structure carrying the lower line will have a row of columns on each curb line and in the center of the street, capped by box-girders supporting a deck of longitudinal I-beams with a concrete deck and ballasted floor.

The Rock Island line has a viaduct of five through-girder spans of 85 to 90 ft., with a total length of 630 ft. Owing to the skew location and the width of the five-track bridge, it was necessary to adopt a steel superstructure. There are two lines of girders, 74 ft. apart on the square, but nearly 200 ft. measured along the piers. They are carried partly on concrete piers and partly on steel cross-girders and columns. This complicated construction is shown in Fig. 3.

The piers are very high, being carried to foundations well below the level of the lower track, and are reinforced throughout. Their design is shown in Fig. 4. In the coping is embedded a steel bolster composed of two 15-in. channels and top cover-plate, to which are bolted the seats for the steel floor-beams. They are designed for Cooper's a better distribution of load than a single abutment of large height, the height from top of footing to rail level being about 30 ft.

The floor system consists of plate-girder floor-beams 28¼ to 32¼ in. deep, with spacing from 38 in. to 64 in. Owing to the skew, many of them have one end carried by a girder and the other by a pier (Fig. 3). A pair of Z-bars riveted along the web serve as the support for the deck slab. The girders, shown in Fig. 6, are of very heavy construction, with top and bottom cover-plates, four reinforcing plates and four flange angles. The floor-beams, girders and columns were all incased in concrete, applied with the compressed-air "cement gun." This coating is about 1¾ in. thick for the webs, 2 in. for the bottom flanges of the floor-beams and 3 in. for the flanges of the girders. It is reinforced by wire mesh and by steel rods carried in holes in the stiffeners. A box-car fitted with a broad platform served as a traveler for this work. The platform was carried by long timbers laid across the roof, with inclined braces from the car sills to the ends of the timber.

The bridge floor (Fig. 6) is a reinforced-concrete slab 16 in. thick, inclosing the upper part of the floor-beams. Beneath this is a 5-in. slab at the level of the bottom flanges, leaving air spaces between the floor-beams. At the ends of the spans, where an expansion joint is left in the floor, this joint in the lower slab is covered by a 2-in. slab of concrete. Upon the top of the concrete floor is a waterproofing course of felt and pitch; this is carried up 6 in. at each side and secured in a notch in the concrete casing, so as to prevent any water from getting beneath it.

The steel girders, weighing about 44 tons each, were shipped complete and hoisted into place by locomotive cranes standing on the tracks below and having 60-ft. booms (Fig. 1). These cranes also set the floor-beams in place.

The viaduct was built by the railway company's special force organization for track-elevation work, except that the steel erection and the cement-gun work were done by contract. It was under the direction of Robert H. Ford, Engineer of Track Elevation, who is in direct charge of the organization noted above and reports to C. A. Morse, Chief Engineer of the Chicago, Rock Island & Pacific Ry.

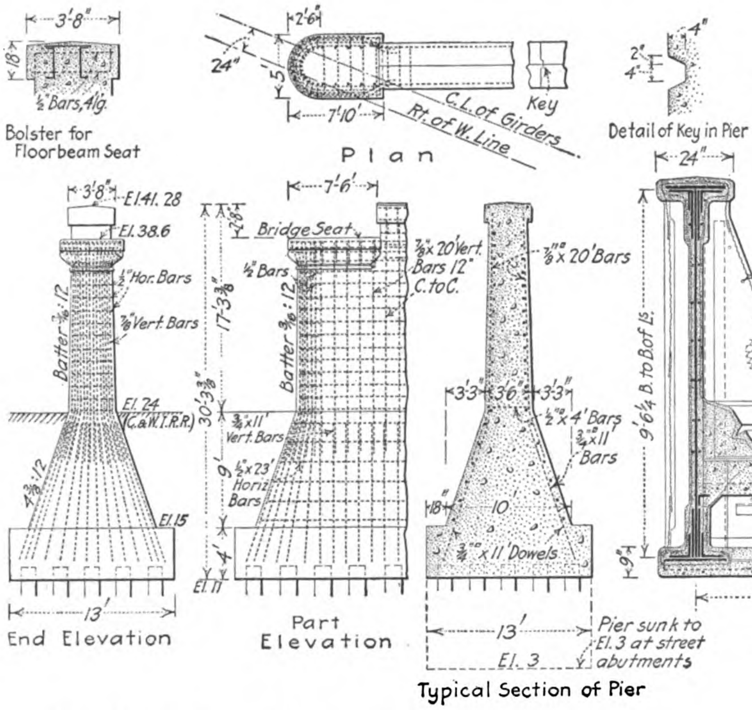

FIG. 4. CONCRETE PIERS OF 79TH ST. BRIDGE
(Note bolster for floor-beam seat)

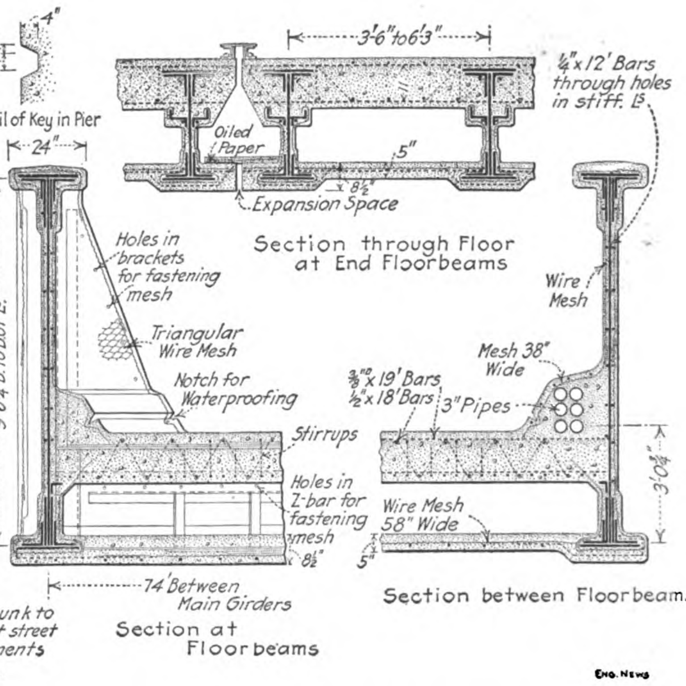

FIG. 6. CROSS-SECTION OF STEEL SPANS
(Showing concrete casing of girders and floor-beams)

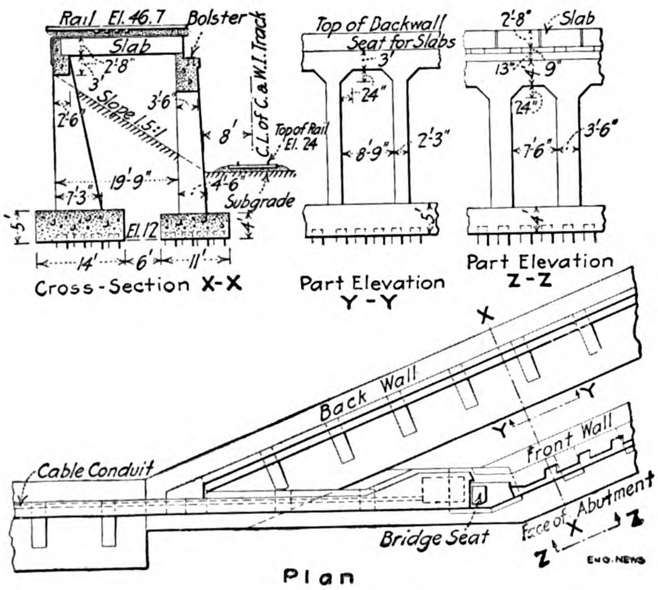

FIG. 5. DETAILS OF HOLLOW ABUTMENT
(Both walls pierced with openings and supporting a slab deck)

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Making Over a Storm Sewer at Lincoln, Neb.

By GEORGE W. BATES*

Three rainfalls at Lincoln, Neb., in May, June, and July, 1914, having intensities of 5.28, 4.80 and 7.56 in. per hr. for 5-min. periods, produced flooded conditions at a pocket in the street grades 2 ft. lower than the nearest surface outlet. The area draining toward this pocket is 178 acres, and the storm sewers previously constructed were capable of carrying off 3 in. per hr. from this territory.

An examination of the main sewer showed that it was not filled, while it was known that the 3½x6-ft. lateral from the pocket was working under a 3-ft. head (see Fig. 1). The main sewer at the junction of the main laterals was 8 ft. wide and 6.4 ft. high, with a flat bottom and a semicircular top, and a flow-line grade of 0.0053. Beyond this the sewer was considerably larger, and dropped at the rate of 0.014, giving sufficient capacity. The light-grade portion was constructed wholly of limestone, the floor being limestone slabs set on edge, apparently without mortar.

A study of the situation indicated that it would be

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